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Tactical Technology Office (TTO)
TTO Overview

As Dr. Tether explained, DARPA's job is to reach into the world of scientific and technological advancements and create new systems that bring new capabilities to the warfighter.

The Tactical Technology Office is about building systems that make use of basic technology advances for the benefit of the warfighter. The Tactical Technology Office, or TTO, has major thrusts in unmanned systems, such as unmanned aerial vehicles, and in developing new systems for outer space.

Spectacular advances in microelectronics have enabled regular breakthroughs in computer processing and in communication systems. These, in turn, have enabled the development of increasingly capable unmanned systems. Exploiting these systems for military applications has been and will continue to be a major thrust for TTO.

The ability to build more functionality with reduced weight and substantially reduced power consumption has enabled the development of mini-satellite systems, now called smallsats and microsats. Many PMs in TTO are doing very exciting work in space systems, especially smallsats and microsats, which you can learn about in the Space Activities Group presentation.

Our choice of programs is also driven by other advances in basic technologies. For example, large advances in the area of lasers, which you have heard about, are enabling new communication systems and new sensor systems, which in turn are driving new capabilities for platforms.

Advances in materials and in navigation and control have led to exciting new possibilities for advanced airframes. You'll be hearing about these during the TTO presentations.

Let me elaborate by giving you a glimpse of the future of unmanned systems as seen from TTO's vantage point. We see a succession of unmanned systems, each one building on the technology developed by its predecessors. A key aspect in this cycle of improvements is that each system will exploit fundamental advances in computation, driven by improved processors and improved software, in order to take on more challenging missions. The increasing challenges can be due to the ability to operate in a more difficult environment or in taking on a more complex mission.

To illustrate this, let me briefly trace one developmental thread. Lets begin with Global Hawk, which was a TTO program in the 1990s. Global Hawk flies at high altitudes, a relatively simple environment, and does ISR (that is, the gathering of intelligence, surveillance, and reconnaissance) from long ranges, which is a relatively straightforward mission.

The UCAV, which is a current TTO program, has a combat mission that is much more complex than Global Hawk's ISR mission. The UCAV will operate in the extremely demanding role of suppression of enemy air defenses, destroying enemy surface-to-air missile sites. The UCAV will provide revolutionary new tactical airpower and create a new paradigm in aircraft affordability. Colonel Mike Leahy will describe the UCAV program for you and bring you up to date on recent flight tests.

Operation on and around an aircraft carrier is substantially more difficult than working in the environment of a ground-based airfield. The UCAV-N program will address this challenge, along with working on unmanned air-to-air refueling.

When an air vehicle moves closer to the ground, closer to targets, and closer to unfriendly air defenses, autonomous operation becomes still more challenging. We are taking on this challenge with a new program, UCAR, which stands for Unmanned Combat Armed Rotorcraft.

Situational awareness is critical to success for the future warfighter and forming a complete picture of the battlefield will require the integration of a variety of sensors positioned at appropriate spots in, around, and above the battlefield. We are working on a number of capable autonomous platforms: small, lightweight, ducted-fan air vehicles, and unmanned ground vehicles. TTO's efforts will not only develop these capabilities, but also enable the operation and integration of sensor systems into these platforms.

Now let me show you some of the other platforms that TTO is working on.

One such platform is the A160, an unmanned helicopter capable of 40-hour endurance. Frontier Systems has achieved this performance by combining many aspects of modern aircraft design, most notably using a rigid rotor. Most helicopters work by adjusting the pitch of the rotor, but the A160 varies the speed of the rotor instead. This was the first flight of the A160. The A160 can fly high above the battlefield, where it can serve as an excellent platform for a communication relay, or as a platform for a radar capable of detecting motion on the battlefield; e.g., vehicles that are moving, even quite slowly.

Here is one of those organic air vehicles that I mentioned earlier. Surveillance platforms, indeed, the entire ISR network of the future, will include sensors that can be carried very close to the target of interest to obtain imagery for positive ID. Small, highly capable sensors will be carried aboard small air vehicles and can serve as extensions of the eyes and ears of Soldiers, Marines, and Special Forces troops.

Turning to earth, an unmanned ground vehicle, or UGV, is a car without a driver. The operation of a UGV is substantially more challenging than that of an unmanned aerial vehicle, or UAV, essentially because the UGV has to navigate a road or move along the ground. However, UGVs can perform unique functions on the battlefield, and so it is worthwhile to try to solve the challenge of autonomous operation of ground vehicles. Scott Fish is working on two efforts aimed at developing UGVs. First, the UGCV Program. In this program, we are exploiting the absence of a human in the vehicle, which should allow us to realize much higher off-road mobility and higher payload fractions than can be achieved in a vehicle where the design is constrained by the need to safely carry a human. Scott is also working on the experimentally focused PerceptOR Program to develop and evaluate algorithms for enhanced off-road navigation.

The Quiet Supersonic Platform is exploiting advances in supersonic aerodynamic design and supersonic engine design. We believe that we can reach the goal of a Mach 2.4 cruise air vehicle that can carry 25,000 lbs with a range of 5000 miles. Moreover, we believe that the gross take-off weight of this bird can be as little as 100,000 pounds.

You are no doubt aware that hybrid cars are beginning to make a strong showing in the consumer automobile market. Hybrid vehicles could be important in providing advanced sensor platforms for the military. The RST-V program is an example of how the application of advanced hybrid electric technology can lead to a fuel-efficient vehicle that has excellent off-road performance. This project is designing a vehicle that can fit in a V-22. Moreover, many of the RST-V technologies will be applicable to other advanced ground vehicles that don't have the V-22 constraint.

I hope that my remarks and the briefings that follow will give you a sense of the tools we are building for warfighters in the future. Thank you for your attention and for coming to listen to the exciting work being done in TTO and throughout DARPA. Most of all, thank you in advance for your creative ideas and for working with us on exciting, challenging, and important programs.